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Determinants of occupational injuries among metal workers in Kamukunji Jua Kali market, Nairobi

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Abstract
An Occupational injury is any personal injury, disease or death resulting from an occupational accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity. Today, despite all efforts by those concerned with the workers' health, occupational accidents and injuries cause a huge human to suffering workers and their families and economic losses; public awareness of occupational health services remains generally low. Furthermore, occupational health does not get the priority it deserves. The purpose of this study was to establish the determinants of occupational injuries among Jua kali metal workers. This was achieved by identifying the factors contributing to the occurrence of occupational injuries among metal workers; and identifying the appropriate measures put in place to prevent the occurrence of occupational injuries. The study used a cross sectional descriptive design. The sampling frame is estimated to be 2455 workers in 782 workshops. Kamukunji Jua Kali Area was purposively selected because it is the biggest jua kali market in Nairobi County. Systematic sampling method was used to select 258 workshops. With the workshops as cluster, cluster sampling was used to determine the number of respondents interviewed in each workshop. The desired number of respondents was then randomly selected Observational checklist was used for data collection. Three officials from Kamukunji Jua Kali Association were interviewed at the Shauri Moyo office. The collected information was coded and entered in a computer program. The data was then analyzed using specific statistical tests. Initial letter authorizing the study was obtained from Mount Kenya University and permission from the Nairobi City County. According to the study injuries could be minimized by provision and proper use of PPEs, decongesting workshops, guarding of machines and by reducing working hours.

Keywords: factors, occupational injury interventions, metal workers, jua kali

Introduction
An Occupational injury is any personal injury, disease or death resulting from an occupational accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity. Today, despite all efforts by those concerned with the workers' health, occupational accidents and injuries cause a huge human to suffering workers and their families and economic losses; public awareness of occupational health services remains generally low. Furthermore, occupational health does not get the priority it deserves. This simulation must be changed and action needs to be taken to stimulate an accelerated response nationally and internationally [1].

The Jua kali sector is adversely affected by limited access and adherence to the health and safety regulations. This is because the Occupational Safety and Health Act cap 15 does not cover this sector, yet this is a sector where workers and operators are exposed to all sorts of occupational hazards and other forms of work related accidents emanating from nature of their work and sites, equipment and materials used, mostly without any protective measures [2].

Injuries related to inadequate safety and health standards are particularly evident in the case of the informal sector. Informal sector workers do not have the necessary awareness, technical means and resources to implement health and safety measures. Protection of the health and safety of workers in the informal sector is a big challenge which should be faced with an integrated approach to health promotion, social protection and employment creation. A poor work environment, including inadequate premises and often very unsatisfactory welfare facilities, as well as practically non-existent occupational health services are causing large human and material losses. This situation burdens the productivity of the Kenyan economy, impairs health and general well-being, and is detrimental to the quality of life of informal sector workers [3].

There are enterprises mushrooming daily in urban and peri-urban centres in Kenya that are known as Jua kali or hot sun industries because of the place in which they operate. These are not fixed premises: the sites are commonly n form of roadsides, open places and pavements in front of buildings. They are restricted by the local government laws so that most jua kali workers operate illegally and are subjected to evictions and confiscation of their material goods and products by the police. According to the Factories and Other Work Places Act Cap 514 Laws of Kenya (192) sexual 5(6) open air premises are not excluded from the definition of a factory Jua Kali industries existed even before the 18th century, when an industrial revolution was taking place in Kenya. The men used to make the type of hoe (jembe) which was for digging. This kind of hoe can still be seen in the national museum [4].

The sector however was popularized by the 1972 ILO mission of Kenya. Since then the government policies have emphasized the importance of supporting the growth of the sector, owing to its key role in job creation, income generation and developing of entrepreneurship. Never the less, Jua kali premises are never inspected and priority is always given to enterprises located in industrial zones. Safety and health of workers in the Jua kali sector therefore remains behind. In most countries occupational health services are not available for micro and small enterprises. However, their occupational health and safety needs are evident [5].

Irrespective of the many injuries reported in Jua Kali metal workshops in Kamukunji, the provision and utilization of personal protective equipment is very low. Most of the employers in the Jua Kali metal industries are ignorant of the workers safety [6].

A leading Industrial Safety Engineer, developed the Domino Theory [7]. He believed that all accidents could be modelled with a chain of five factors. They were: Ancestry and social environment; the fault of a person; an unsafe act and / or physical hazard; an accident; and the resulting injury. With moderate and high psychological distress it wills more likely leading to the risk of workplace accident [8].

Major accidents may generally be caused by human failures or errors, technical faults or external forces and are typically caused by such things as the elements, spontaneous explosions and gravity. The leading causes of workplace accidents are tiredness, overexertion, carelessness and improper technique or lack of training also can cause accidents at work, especially when dealing with machinery or manually operated equipment [8]. Common workplace injuries include head injuries, back and neck injuries, and sprains or broken bones result from employees doing physical activity around the workplace without proper precautions; unsafe work environment; fatal and traumatic accidents are more common in factory and unskilled laborer jobs such as construction or assembly line work. Workplace accidents can be prevented by avoiding over confidence, shortcuts; adopting safety procedures, following complete instructions when starting a task, maintaining good housekeeping, mental attention; and having good planning of work [9].

Workers in small and medium sized enterprises still typically encounter poor and often hazardous working conditions [7]. Owners and managers of these small scale enterprises still typically struggle with low productivity, poor quality of output and lack of competitiveness in a globalizing economy. Moreover, the number of such enterprise and the number of workers employed in them continue to grow. The government is pre-occupied with problems related to the basic need of food, shelter and employment and the matter of occupational health and safety is not prioritized at all [8]. The result of this state of affairs in most cases has been the continued existence of very injurious working conditions, high accident rates, loss of skilled labor and negative development [10].

Workers in small scale enterprises face the range of injuries experienced in larger enterprise such as physical or energies chemical, mechanical, ergonomic, biological or micro predators climatic (macro and micro), psycho-social climate or factors [11]. Noise is the biggest problem for most of the workers who carry out their processes together. Exposure to too much noise can have emotional auditory and physiological effects. Prolonged exposure, (>85 db) to excessive noise can damage the sensory mechanisms of the inner ear and can lead to fatigue, anger, irritability and even hearing loss. The risk of exposures to heat is common since these workers operate in outdoor areas except for a few organized workers who have made temporary sheds. Non-ionizing radiation like the one produced in electric arc welding can cause conjunctivitis and burns of the skin. Cataract may also develop due to infrared radiation from metal and glass. Ionizing radiation can cause skin cancer, bone tumors and lung cancer among painters [12].

Vibrating and rotating tools can cause vibration disorder such as ‘dead hand’ in places where repetitive movement of the hands and forearms are common, the tender sheaths and musculocutaneous junction become inflamed. Accidents may occur and hands end up in amputation due to unguarded machinery [11]. The spray and brush painters are exposed to acids, solvents and paints which may irritate the skin and the eyes causing ophthalmologic and dermatologic conditions. Motor mechanics are exposed to running engines, which may predispose them to lung cancer and carbon monoxide poisoning. They are also exposed to lead and asbestos from the brake linings putting them at risk of contacting asbestosis. Welders are exposed to toxic gases which may predispose them to diseases such as metal fume fever [12].

Jua kali workers work for long hours to be able to make ends meet. They start up as early as 4am. In the end wages may not be paid on time. They are harassed by the law and in most cases they go through a lot stress and anxiety, which may predispose them to conditions leading to ulcers, hypertension, alcoholism and others even turn to drugs when they loose their property [4]. The use of improvised tools and adoption of incorrect postures during long working hours are common phenomena n metal works. People have to be physically fit to do some of the jobs, which is not the case in Jua kali [12].

This includes around 200-300 chemicals known to be mutagenic or carcinogen. The reported adverse effects include infertility in sexes, spontaneous abortion, fetal death, fetal cancer, fetotoxity and retarded development of the fetus or newborn, numerous organic solvents and toxic metals, many biological agents such as certain bacteria, viruses and zoonoses, as well as heavy physical work, are also associated with an increased risk of reproductive disorders [13].

Prevention of occupational injuries is an important task of human resource management. Intervention to reduce occupational trauma should be multi-factorial to be successful. Activities on different levels, workplace visits, risk assessment activities, development projects targeting certain risks, print media and electronic media campaigns, attitude surveys among the general public need to be combined in order to influence claims incidence and underlying occupational morbidity. In depth analyses of the specific tasks and risk exposures identified together with a systematic collection of risk scenarios from exposed workers through critical incident and other techniques, should be the next step of intervention. Occupationally and task related appropriate engineering, ergonomics and design solutions should be developed for the different problems highlighted above. The choice of such applied development activities should be made with a priority towards reducing injury severity. Substantial reductions in non-fatal injuries may reflect changes in work organization, increased automation and improved safety standards. Knowledge of predictors of

work related injury, comprehensive training for workers may contribute to injury prevention strategies especially among newly employed workers. Development of a standardized surveillance occupational injury database across companies with different database configuration is feasible. Personal protective equipment dramatically reduced injuries incidence severity and days lost to medical leave [14].

Employers and have the legal and moral duty to protect the health and safety of workers by preventing workplace injuries and illness. The following is the hierarchy of control in the preferred order as follows: Elimination which involves total removing/rejection of the dangerous processes and raw materials; Substitution where processes and chemicals are substituted for the less hazardous alternatives; Engineering controls where hazards can be redesigned through isolation/enclosure, machine guards, ventilation, wet methods and mechanical aids; and Administrative controls in which procedures developed include job rotations, limit exposure, permit system, exclusion, safe operating procedures and training. Information, instruction and training provide employees with the skills and knowledge to perform their work in a manner that is safe and without risk to health. It enables them to follow health and safety procedures, use risk control set in place for their protection, and have an appreciation of nature of the injuries, the risk associated with their use and the reason why risk control are used [15].

The regulations requires that the PPE provided must be suitable for the purpose and confirm to a standard approved by the health and safety board and the Kenya Bureau of standards personal protective items appropriate to the injuries encountered should be employed. The different types are: Personal protective clothing e.g. aprons, caps, coats, jackets, disposal gloves and overalls; Personal protective devices e.g. air respirators, earmuffs, ear plugs, goggles and gloves; and Personal protective equipment e.g. shield against welding arcs [16].

According to Odhiambo [17], many employers fail to comply with requirements of the factories and other places of work Act Cap 514. Their main reason is that they lack adequate finances, which are needed for improving the working condition. Personal protective equipment protects the wearer against accidents and health hazards. Although PPE gives absolute protection against injuries, there is evidence that they can only give very good protection if properly used. Workers in Jua kali workplace are exposed to various injurious substances which include dust, chemical fumes solvents, welding fumes, sharp objects etc. Work is mainly done manually which results in a high level of exposure. Considering the per capita turnover of informal sector is quite low, the use of PPE is the most predominant mode of control of exposure to the main injuries. It is employer's responsibility to provide and to take measures to ensure that workers use them [16].

The organs of the human body that are vulnerable to attack from external sources are ears, eyes, the skin and the respiratory system. In the case of the first three, a barrier or attenuation device should be worn over the organ. With regard to airborne pollutants, respiratory protection involves the wearing of a device that either cleans the polluted air to a safe level or provides a stream of uncontaminated air from a separate source [18]. According to Odhiambo [17] many employers fail to comply with requirements of the factories and other places of work act Cap 514. Their main reason is that they lack adequate finances, which are needed for improving the working condition. The purpose of the current study was to determine the determinants of occupational injuries and their preventive measures.

Methods and Materials

This study was carried out at Kamukunji Jua kali market. The area was purposively selected because it is the largest Jua kali market in Nairobi County. It falls under Pumwani ward, Kamukunji Sub-county, Nairobi City County. Kamukunji Sub-county consists of central to eastern area of Nairobi County Kenya. The Sub-county borders Starehe Sub-county on the North and West, Makadara Sub-county on the East and Southern part, and a narrow section of Kasarani Sub-county. The Sub-county has an area of 11.7sq km of which half of the space is occupied by Moi Airbase. This leaves about only 5.8sq km space for human occupation, commercial centres and other social amenities.

This was descriptive cross sectional descriptive design in which 332 respondents were selected using systematic random sampling from a population 2455 workers in Jua Kali industry in Kamkunji Sub County. Structured questionnaires were administered to the sampled Jua Kali workers to collect data. An observation checklist was also used to collect data by the investigators. Key informants interviews were carried out by the investigator on three officials from Kamukunji Jua kali Association. The investigators used triangulation, which refers to the use of more than one method for gathering data. This was achieved by collecting the data through structured questionnaires from respondents, observation checklist and interview from key informants. Quantitative data were coded and entered in statistical computer package (SPSS version 20). Data cleaning was done to check for errors during data entry and completeness. Data were then analyzed using descriptive statistics and presented in graphs, charts and tables.

Ethical Clearance

The investigators obtained the letter authorizing the study from the Mount Kenya University and Nairobi City County. Informed consent was sought from the respondents before conducting interviews. Respect of persons and autonomy was ensured giving respondents freedom to decide on whether or not to participate. They were made aware that they are free to withdraw from the study at any time, without giving a reason. The respondents were informed that there were no risks or benefits they were subjected to by participating in the study. The respondents were assured of anonymity and confidentiality of the data at all levels of the study.

Results

Factors Contributing to the Occurrence of Occupational Health Injuries

The researcher sought to establish the factors associated with occurrence of occupational health injuries among metal workers

Common causes of occupational health injuries among metal workers

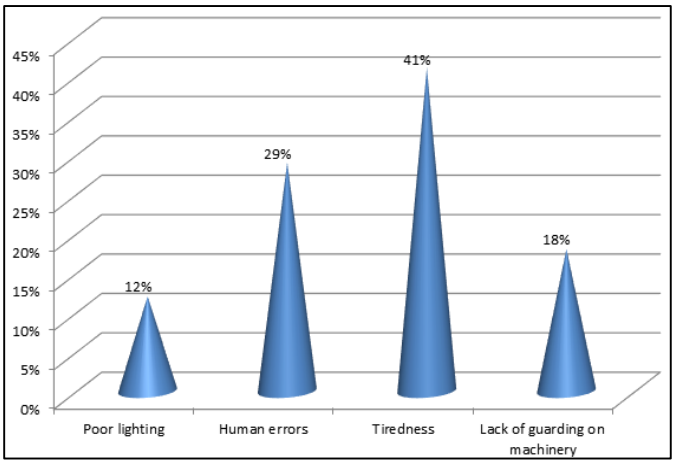

Fig 1: Common causes of occupational health injuries

The figure 1 shows the common causes of occupational health injuries among metal workers. Most of the respondents said accidents were caused by tiredness, 29% due to human errors, 18% due to lack of guarding on machinery while 12% said due to poor lighting.

Number of working hours in a day

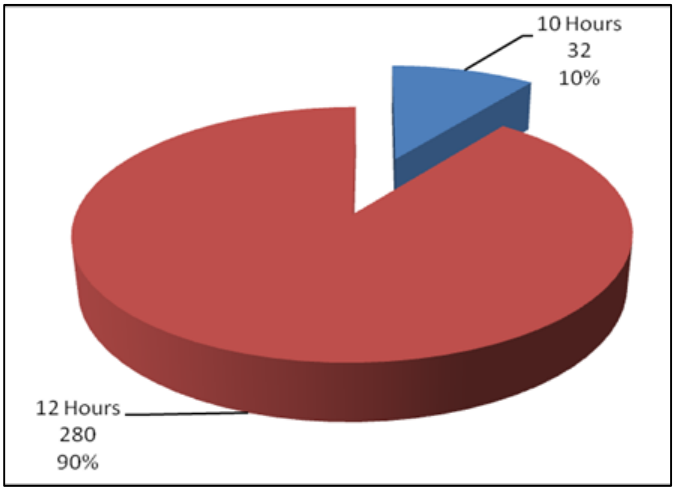

Fig 2: Number of working hours in a day

The figure 2 shows the number of working hours in a day. Majority (90%) of the workers worked for 12 hours in a day while 10% worked for 10 hours.

Whether workers had off duty days

Table 1: Whether workers had off duty days

Status	Frequencies	Percentage (%)
Yes	43	13
No	289	87
Total	332	100

The table above represents workers who had off duty days. Majority (87%) of the respondents were not given off duty days while only 13% were given.

Number of off duty days in a month

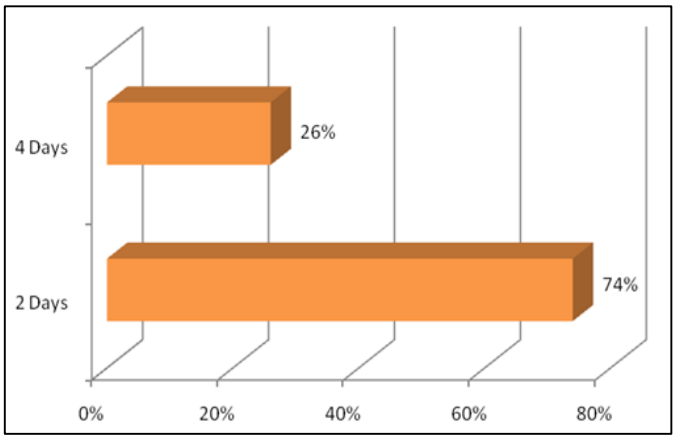

Fig 3: Number of off duty days in a month

The figure 3 shows the number of off duty days for metal workers within a month for the workers who had off days. Majority (74%) of the respondents that had off duty days were given only 2 days in a month while 26% were given 4 days in a month.

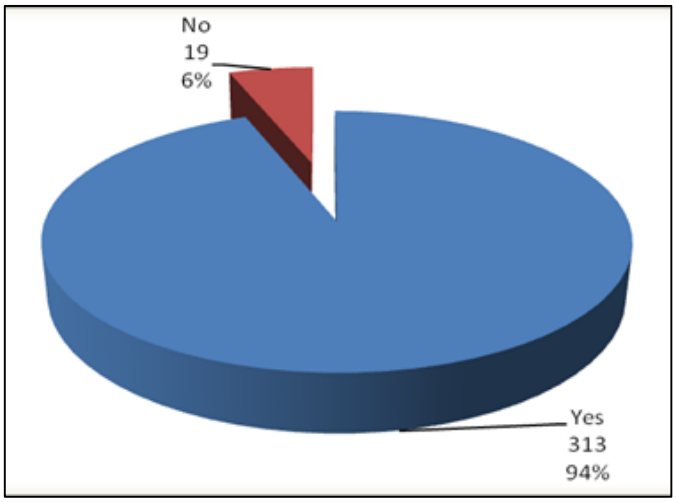

Fig 4: Whether workers had undergone any form of training on the kind of work done

The figure 4 shows whether metal workers had undergone training in relation to the work they are doing. Majority (94%) of the respondents had undergone some form of training on the work they were doing while 6% had not.

Where the workers were trained about their work

Table 2: Where the workers were trained about their work

Place of training	Frequencies	Percentage (%)
On job training	266	85
Technical school	34	11
University	13	4
Total	313	100

Majority (85%) of the workers had undergone an on job training, 11% had been trained in technical schools and 4% were university graduates (Table 2).

Occupational health and safety training

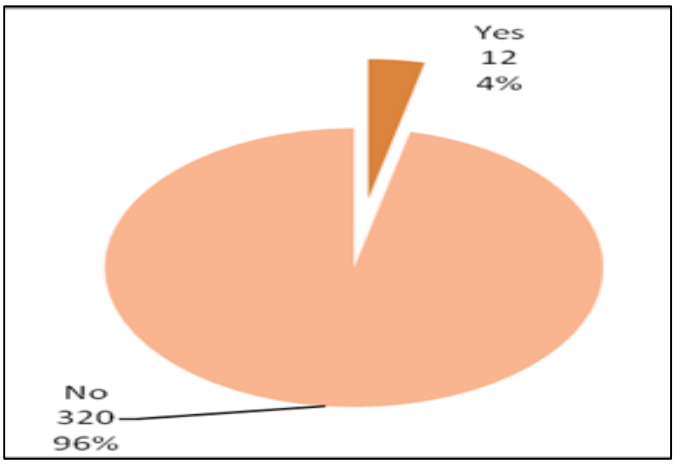

Fig 5: Whether workers were trained on occupational health and safety

Majority (96%) of the respondents had not received training on occupational health and safety, while only 4% had been trained (Figure 5).

Type of tools mostly used by the worker

Table 3: The type tool most commonly used by the worker

Type of tool	Frequencies	Percentage (%)
Welding machine	68	20
Grinding machine	27	8
Spray pump	10	3
Cutting machine	106	32
Hammer	95	29
Vice	12	3.9
Drilling machine	14	4.1
Total	332	100

Most (32%) of the workers used a cutting machine, 29%used a hammer, 20% used a welding machine, 8% used a grinding machine, 4.1% used a drilling machine, 3.9% used a vice and 3% used spray pumps(Table 3).

Measures put in Place to Prevent the Occurrence of Occupational Injuries

Provision of PPEs

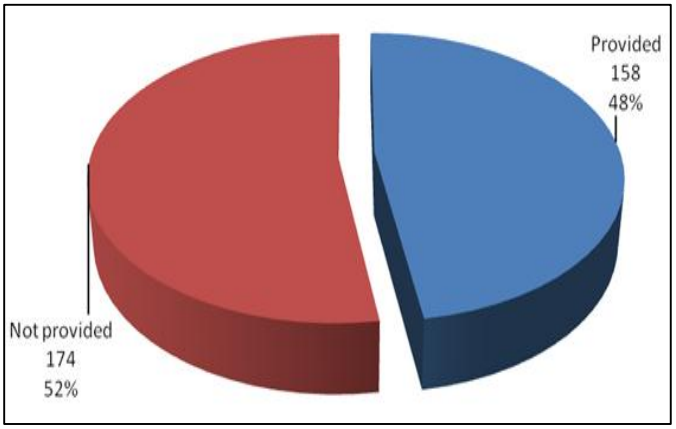

Fig 6: Provision of PPEs

The figure 6 describes the status of provision of PPEs for metal workers. Most (52%) of the workers were not provided with personal protective equipments while 48% were given.

Type of PPEs provided

Table 4: Type of PPEs provided

Type	Frequencies	Percentage (%)
Helmets	27	17
Goggles	16	10
Gloves	22	14
Overalls/aprons	93	59
Total	158	100

Concerning the type of PPEs provided for the metal workers to use; Most (59%) of the workers were provided with overalls/aprons, 17% with helmets, 14% gloves and 10% were provided with goggles(table 4).

The respondents were asked whether or not metal workers were using PPEs. Out of the workers provided with personal protective garments, 59% said they always use the PPEs while 41% said they didn't use them.

Table 5: the importance of using PPEs

Importance	Frequencies	Percentage (%)
Protect against accidents	97	61
Protect against dirt	33	21
Employers regulation	28	18
Total	158	100

Most (61%) of the workers said personal protective equipments are importance because they protect against accidents, 21% said they protect against dirt while 18% said it's just an employer's regulation (table 5).

Discussion

Factors Contributing to the Occurrence of Occupational Health Injuries

According to the study, common causes of occupational health injuries among metal workers included tiredness, human errors, lack of guarding on machinery and poor lighting. Major accidents may generally be caused by human failures or errors, technical faults or external forces and are typically caused by such things as the elements, spontaneous explosions and gravity. The leading causes of workplace accidents are tiredness, overexertion, carelessness and improper technique or lack of training also can cause accidents at work, especially when dealing with machinery or manually operated equipment [8].

According to the study, majority of the workers worked for 12 hours in a day and were not given off duty days while only 13% were given. Majority of the respondents had undergone some form of training on the work they were doing. Majority of the workers had undergone an on job training while a few had been trained in technical schools and universities.

The study found out that majority of the respondents had not received training on occupational health and safety. This could be a contributing factor to the high prevalence of occupational injuries among the workers. This agrees with Hilton and White ford who attribute lack of knowledge to lack of training and sufficient information about injuries [8].

According to the study, the type of tools mostly used by the worker included a cutting machine, hammer, a welding machine, a grinding machine, a drilling machine, a vice and spray pumps. This puts them at a risk of being injured during their work. Furthermore little has been done to reduce the hazards related to these tools. This concurs with Batino[10]who noted that the informal sector (jua kali) and its many industries is a major neglected part of the economies of developing countries. These industries have many health injuries arising from various activities which include metal fabrication where we have welding, cutting and brazing, spray painting, panel beating, forging of metals, blacksmithing among many other activities.

Measures put in place to prevent the Occurrence of Occupational Injuries

According to the study most of the workers were not provided with personal protective equipments. The type of PPEs provided included overalls/aprons, helmets, gloves and goggles. This shows that not all the required PPEs were provided by the employers. This shows little has been done by the relevant authorities to ensure compliance to the occupational health and safety regulations. This concurs with Atieno, that Jua kali premises are never inspected and priority is always given to enterprises located in industrial zones. [6] Safety and health of workers in the Jua kali sector therefore remains behind. In most countries occupational health services are not available for micro and small enterprises. However, their occupational health and safety needs are evident. Despite the knowledge shown by most of the workers on the importance of personal protective garments, out of the workers provided with personal protective garments, not all of them were using as 41% said they didn't use them.

According to the researcher's observations, 32 workers were in the required personal protective garments contrary to what the 94 workers had filled in the questionnaire. Out of the 32 workers in appropriate personal protective garments, only 8 were well maintained while the rest were worn out. This shows that some workers were provided with personal protective garments yet they were not using them. It also shows there is laxity among some workers on the use of personal protective equipments.

It was found out that 90% of the workshops were congested and majority of the workshops had material hanging that could easily fall and injure the workers. This increases the risk of accidents or injuries in the workshops. 96% of the workshops had no first aid kits. The ones that had the first aid kits were also not well equipped. This shows the poor state of emergency preparedness among workshop owners and workers. Majority of the workshops were dirty while 12% were fairly clean. Only 30% of the workshops had fire extinguishers, majority (75%) of which were not serviced.

Conclusion

The study concludes that injuries could be minimized by provision and proper use of PPEs, decongesting workshops, guarding of machines and by reducing working hours. This clearly shows the workers are aware of the possible ways of reducing or preventing occupational health injuries at the workplace. Majority of the workers worked for 12 hours in a day. Majority of the respondents were not given off duty days.

The study further concludes that majority of the respondents had not received training on occupational health and safety. The occurrence of injuries at their workplace was regular as compared to the rare occurrence amounting to 6%. According to the study most of the workers were not provided with personal protective equipments. The type of PPEs provided included overalls/aprons, helmets, gloves and goggles.

Acknowledgment

The authors declare that Sammy Wafula simiyu and Wilberforce Cholo contributed equally to the completion of this manuscripts and that there is no conflict of interest.

References

1. Fedotov IA. Occupational health services as a key element of national occupational safety and health systems, Sweeden Journal on international news on Environmental Health. 2009, 1(1).
2. Hasle P, Limborg HJ. A review of literature on preventive occupational health and safety activities in small enterprises. Indust Health. 2006; 44:6-12.
3. National Census Report. Ministry of Planning and National Development, 2010.
4. Economic Survey. Kenya National Bureau of statistics, 2011. Available online at http://www.knbs.or.ke
5. Atieno GA. How the public employment services is developing and promoting self-employment in Kenya. A paper presented in Brazeville Congo, 2011.
6. Beatrice N, Kituyi. National Profile on Occupational Safety and Health - Kenya. International Labour Office, Geneva. Republic of Kenya – Ministry of Labour(GoK), 2013.
7. Heinrich HW, Petersen D, Ross N. Industrial Accident Prevention, 5th Edition, McGraw-Hill, New York, 1980.
8. Hilton MF, Whiteford HA. Associations between psychological stress, workplace accidents, workplace failures and workplace successes, Int Arch Occup Environ Health. 2010; l83:923-933.
9. Sunil K. Occupational accidents and injuries. Occupational Medicine Division, National Institute of Occupational Health, Gujarat, India, 2011.
10. Batino JM. Work improvement in small enterprises. Asian-Pacific newsletter on occupational health and safety. 2012; 12(2):36.
11. Leowenson D. Structural environmental and behavioural interventions. Worksite health promotion. American journal on preventive medicine. 2007, 3(Supp 5).
12. O'Donnel M. The changing concept of health promotion in the workplace. The Genesis of workplace. Vancouver, Canada. 2010, 497.
13. World Health Organization. The World Health Report. Geneva, Switzerland, 2008.
14. Sorock GS, Lombardi DA, Hauser RB, Eisen EA, Herrick RF, Mittleman MA, A case-crossover study of occupational traumatic hand injury: methods and initial findings. Am J Ind Med. 2009; 39(2):171-179.
15. Gikonyo E. The impact of occupational injuries on the health of metal workers in Kenya's jua kali sector. Project paper. Nairobi, Kenya, 2012.

16. Gitonga SK. Proceedings of the regional symposium on occupational health and safety. African Newsletter on occupational Health and Safety. 2010, 2.
17. Odhiambo CB. Injuries in steel industry. African Newsletter on Occupational Health and Safety. 2012, 1(3).
18. Maxwell A. Industrial Injuries, Health and Safety Handbook. 2nd Edition, 2005.
19. Freedman DA. Statistical Models: Theory and Practice, Cambridge University Press, 2005. ISBN 978-0-521-67105-7
20. Fisher RA. Statistical Methods for Research Workers. Oliver and Boyd (Edinburgh), 2001. ISBN 0-05-002170-2.